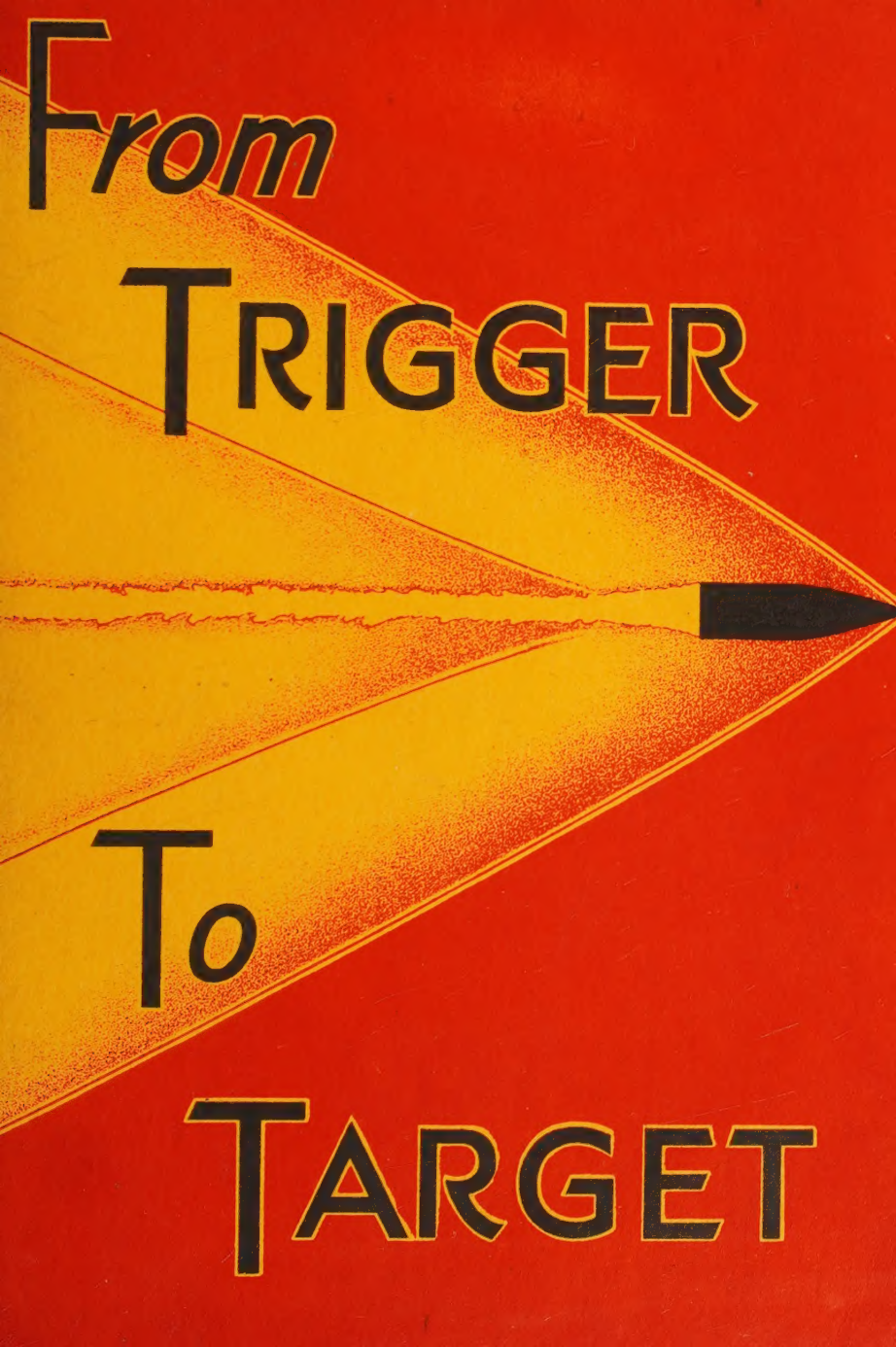
From Trigger To Target



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THE PETERS CARTRIDGE COMPANY
Cincinnati, Ohio, U. S. A.

FROM TRIGGER TO TARGET

THE PETERS CARTRIDGE CO.
Cincinnati, Ohio

AT that period in the history of the Imperial Army of France when it had behind it Marengo and Austerlitz and before it Jena, probably the Emperor Napoleon was eminently justified in considering it to be the finest body of troops of its day.

However, on the morning of the battle of Jena this great army was for a time forced to remain practically inactive, although often within pistol shot of the enemy, because of a heavy fog which covered the field.

So it is in many of the problems encountered in ballistics where the fog of tradition and inadequate facilities have long clouded the issue. Especially has progress been retarded towards a clearer understanding of the various factors which determine the accuracy and functioning of a given cartridge.

The cartridge manufacturer is confronted constantly with a great variety of problems in the solution of which mere visual observation is of little, if any, use. For instance, the firing of any cartridge takes place in so short a space of time that even with the slowest of lock mechanisms the entire time elapsing from the release of the firing mechanism to the emergence of the bullet at the muzzle of the arm is, in general, considerably less than ten one-thousandths of a second. Of this time interval usually three-fourths is used in the functioning of the firing mechanism and only one-fourth in the firing of the cartridge.

When it is considered that in moving pictures a frequency of sixteen cycles, or changes, per second appears continuous to the naked eye, it will be obvious that ballistic phenomena of the type we are considering cannot be adequately investigated without unusually complete laboratory facilities.

Realizing that in general it is neither efficient nor feasible to attempt to rectify a deficiency until the cause is understood, The Peters Cartridge Company has spared no expense in developing and installing the most unusual and complete equipment for ballistic research ever assembled in any laboratory.

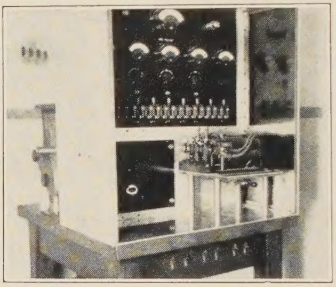


FIG. II.—*Control panel of oscillograph switch board.*

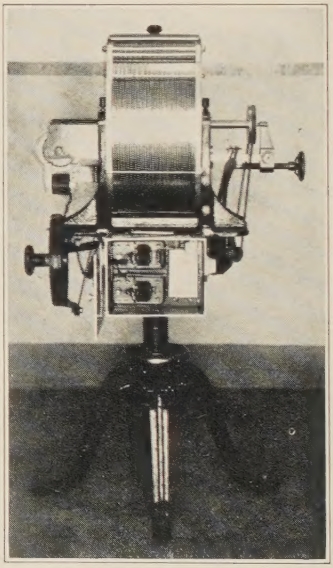


FIG. I.—*Special high-speed oscillograph camera used in precise velocity determinations, primer ignition and similar work.*

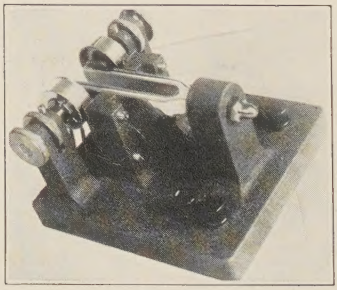


FIG. III.—*Special tuning fork, electrically driven, used as the time standard in all high speed oscillograph work.*

One of the phenomenal features of this equipment is a highly specialized electric photographic apparatus in the Physical Laboratory which enables The Peters Cartridge Company to obtain actual instantaneous records or photographs of any shell or cartridge in any stage of firing and to check its functioning accordingly.

A special high speed oscillograph camera (see Figs. I and II, page 2) equipped with a precision timing mechanism (see Fig. III, page 2) capable of measuring a second to one part in ten thousand and even more accurately, if required, enables The Peters Cartridge Company to determine velocities, primer ignitions and similar vital factors with an accuracy hitherto not approached.

By means of this ultra modern apparatus, representing as it does the utmost precision in equipment of its kind, The Peters Cartridge Company has been enabled to investigate not only its own product but that of others as well. In this manner it has been possible to establish standards of accuracy and functioning unbiased by personal opinion.

It is one of the aims of this booklet to show how The Peters Cartridge Company is using this most modern equipment in thoroughly testing and developing the various components which comprise the finished cartridge.

Peters Metallic Cartridges

From time immemorial, insofar as the cartridge manufacturing industry is concerned, it has been the custom to test the functioning of primers by the so-called drop test. This test consists simply in dropping a ball from a given height upon a suitable firing pin which in turn fires the primed shell.

Not only is such a test very misleading but it does not duplicate the blow of the firing mechanism of the arm in which it is used. Thus the same amount of energy may be secured by dropping a one ounce ball twelve inches as is obtained by dropping a two ounce ball half as far but the impact at higher velocity in the first case will be much more apt to fire the primer than that obtained in the second case.

About the only information available in drop tests of a given lot of primers is that they will or will not fire with a given blow. If they do fire no data are available from which to determine how nearly they may have approached a misfire or hangfire condition, and similarly with a misfire or hangfire we cannot tell by means of the drop test how nearly it may have approached to satisfactory

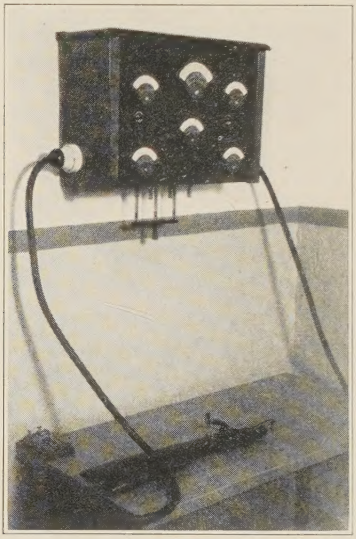
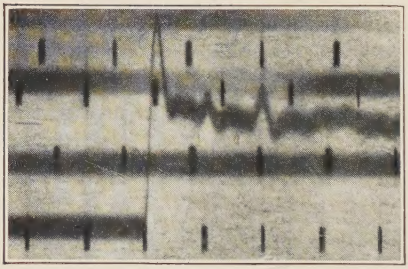
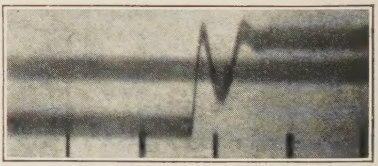


FIG. IV.—*Intensity of ignition apparatus for use in determining the efficiency of any primer.*

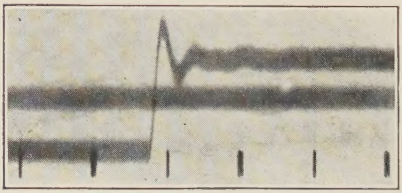


5-A

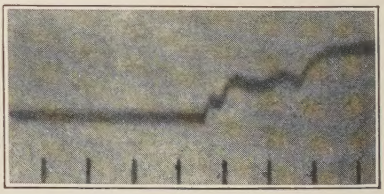
FIG. V.—*Typical primer records.*



5-B



5-C



5-D

functioning. In fact, the only purpose of the drop test is to test the sensitiveness of the primer.

To meet the requirements of determining both qualitatively and quantitatively the ability of a given primer to properly ignite the powder charge the Physical Laboratory of The Peters Cartridge Company developed the primer ignition apparatus shown in Fig. IV (see page 4). By means of this equipment the intensity of ignition of a given primer may be obtained and recorded on the oscillograph camera shown in Fig. I (see page 2). Typical records showing the intensity of a number of primers of different types are shown in Fig V (see page 4).

In these four oscillograph records, heat intensity is indicated by the height reached by the wavy lines, while time of combustion is measured horizontally, the short vertical lines indicating thousandths of a second. Ideal performance is represented in the Fig. 5A (see page 4) where the priming mixture burns in an extremely short time (about two ten-thousandths of a second) and generates great heat quickly. The much lower temperature and slower rate of burning of the primer shown in Fig. 5B (see page 4) render this primer very unsatisfactory in comparison with that of Fig. 5A (see page 4).

In addition to the other features noted the primed shells are fired in a standard arm which is adjusted to give a blow of equal strength to each primer.

With this equipment The Peters Cartridge Company is enabled, as is no other cartridge company, to measure both qualitatively and quantitatively the effectiveness of its primers under any and all conditions.

Bullet Accuracy

There was a period in the history of small arms when it was considered that if the bullets were swaged and in addition possessed the requisite weight, bearing length, diameter and hardness that little more was to be desired. However, all of these factors may be quite correct and yet the most erratic results may be encountered if special care is not taken to insure a base as nearly symmetrical as it is possible to make it.

The region in the immediate vicinity of the muzzle is one of the most critical in the firing cycle of any arm. In this region the gas is still rushing past and pressing on the base of the bullet with tremendous force.

In Fig. VI (see page 7) the muzzle of a Springfield rifle is shown just at the instant in which the boat-tail portion of the bullet is about to leave the muzzle. The powder gas is beginning to rush out around the base of the bullet as is clearly shown by the sound waves forming at that point.

If the base of the bullet is unsymmetrical in any way, either due to a lack of concentricity of the boat-tail portion, to deformations of appreciable magnitude, or other similar causes, there will be an unbalancing component acting on the base due to the gas pressure, which will suddenly tilt the bullet. This force is so great that entirely aside from its effect on the gyroscopic or spinning action of the bullet, even at a range of 30 yards, it will result in a surprising deflection, as can be strikingly demonstrated with bullets deformed as above. If care is taken to properly orient the bullets with respect to the deformation on the base they may be placed at the corners of a square at the target by simply turning each cartridge ninety degrees ahead of its predecessor in the breech.

Figs. VII and VIII (see page 7) show quite clearly the effect of inaccurate bases.

Expanding Bullets

The Peters .30-06 Hollow Point expanding bullet is loaded in one of the most deadly of the big game cartridges. In order to demonstrate the enormous stopping power of this cartridge a series of four instantaneous photographs were taken in the Peters Physical Laboratory showing the bullet in various stages of penetrating a cake of paraffin wax four inches in thickness.

Fig. IX (see page 8) shows a 200-grain, .30-06 Metal Case Hollow Point bullet just at the instant of entering a cake of the paraffin wax roughly four inches in thickness. Some of the wax is being displaced and forced out behind the bullet.

Fig. X (see page 8) shows a .30-06 Metal Case Hollow Point bullet about one and one-half inches out of the paraffin cake and still imbedded in a large mass of the wax which it has pushed out. The heavy dark line seen just ahead of the bullet is a sound wave which it has generated. From the slope of the sound waves, seen on the entering and on the emerging sides of the paraffin cake, we see that this bullet has lost approximately half its velocity or three-fourths of its energy in passing through the paraffin cake.

Fig. XI (see page 9) shows the .30-06 Metal Case Hollow Point bullet roughly eight inches out from the emerging side of the paraffin cake. The lead slug and bullet jacket are seen just behind the

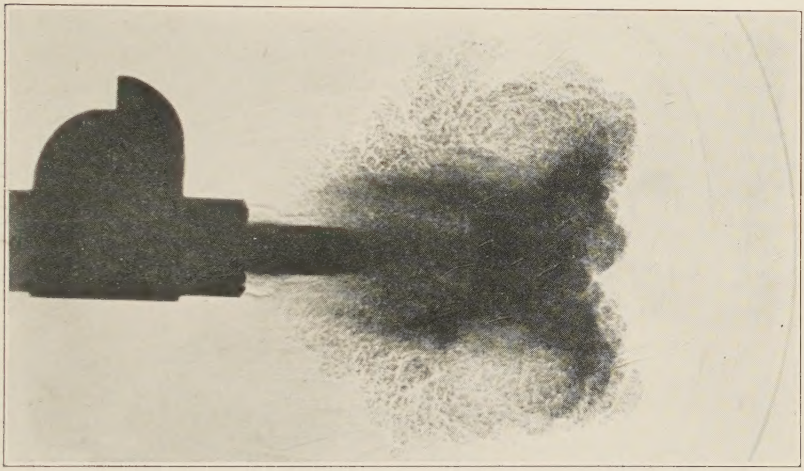
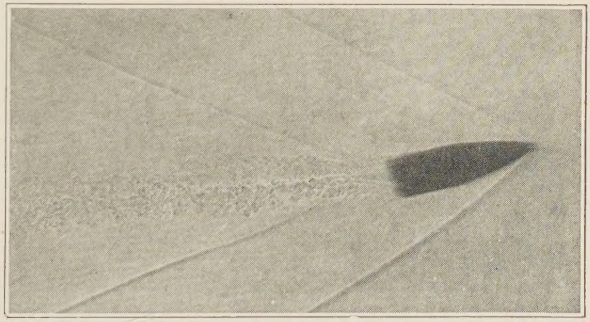
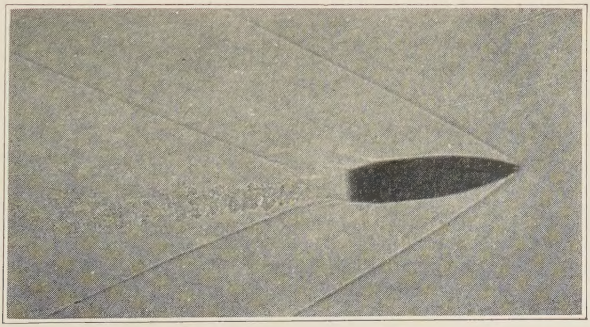


FIG. VI.—*Spark photograph of the .30-06 Springfield rifle just at the instant in which the bullet emerged from the muzzle.*





FIGS. VII AND VIII.—*Spark photographs of bullets showing the effect of inaccurate bases.*

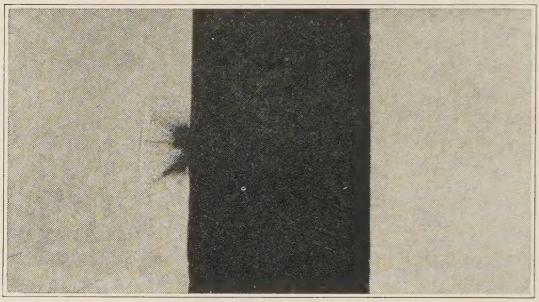


FIG IX.—*200-grain .30-06 Metal Case Hollow Point bullet just at the instant of entering a cake of paraffin wax.*

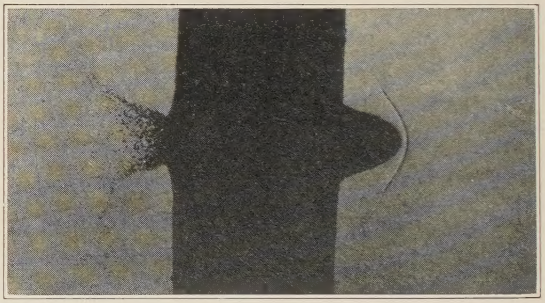


FIG. X.—*.30-06 Metal Case Hollow Point bullet about one and one-half inches out of the paraffin cake.*

"V" shaped sound wave. The paraffin wax is thrown out from both sides of the cake but of course this effect is enormously greater on the emerging side.

Fig. XII (see page 9) shows a .30-06 Metal Case Hollow Point bullet approximately sixteen inches out from the emerging side of the paraffin cake. The bullet and jacket are seen just at the apex of the "V" shaped sound wave. It is evident that the disruptive effect of this bullet is very great.

Peters .38 S. & W. Special Cartridges

The Peters .38 S. & W. Special, .38 S. & W. Special Wad Cutter and .38 S. & W. Special Mid-Range Wad Cutter cartridges are some of the most popular revolver cartridges and are used extensively on the target range.

In Figs. XIII, XIV and XV (see page 10) is shown a .38 caliber Smith & Wesson revolver in various stages of cutting a card using the Peters .38 S. & W. Special Mid-Range Wad Cutter bullet.

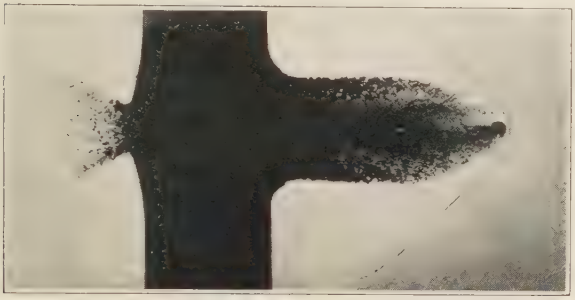


FIG. XI.—*.30-06 Metal Case Hollow Point bullet roughly eight inches out from the emerging side of the paraffin cake.*

FIG. XII.—*.30-06 Metal Case Hollow Point bullet approximately sixteen inches out from the emerging side of the paraffin cake.*

Fig. XIII (see page 10) shows a .38 S. & W. Special revolver firing a Peters Mid-Range Wad Cutter bullet. In this photograph the bullet is practically in contact with the paper card it is about to cut.

Fig. XIV (see page 10) shows a Peters .38 S. & W. Special Mid-Range Wad Cutter bullet after passing a little more than half way through a paper card.

Fig. XV (see page 10) shows a Peters .38 S. & W. Special Mid-Range Wad Cutter bullet after cutting a paper card in two. Although a paper card would generally be considered to have little effect on a bullet nevertheless when struck edgewise in this manner it offers considerable resistance, in this case enough to tilt the bullet slightly.

After seeing the evidence in this last mentioned photograph, one clearly realizes that slight causes sometimes greatly affect the flight of a high-powered bullet. The deflection of such a bullet by a small twig is an example within the experience of most shooters.

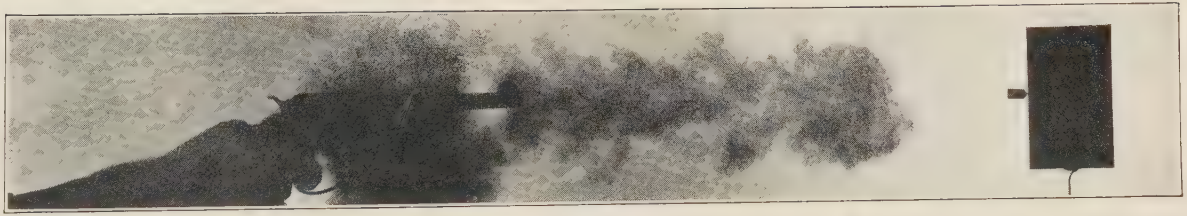


FIG. XIII.- *38 S. & W. Special revolver firing a Peters Mid-Range Wad Cutter bullet. In this photograph the bullet is practically in contact with the paper card it is about to cut.*

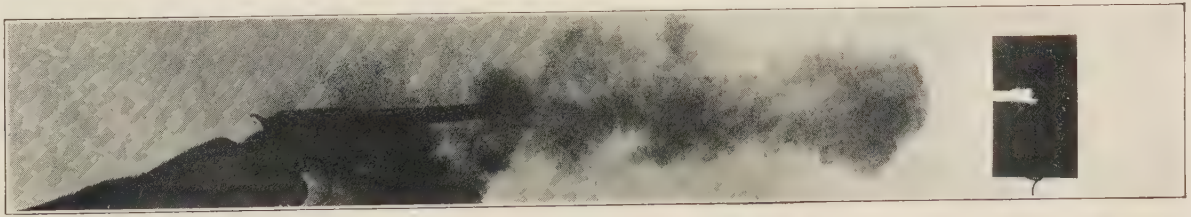


FIG. XIV.—*Peters 38 S. & W. Special Mid-Range Wad Cutter bullet after passing a little more than half way through a paper card.*

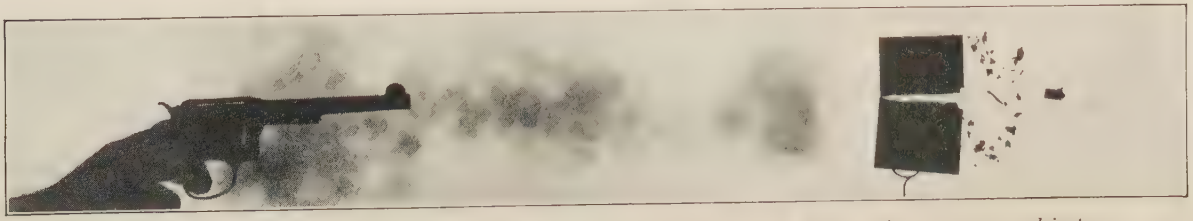


FIG. XV.—*Peters .38 S. & W. Special Mid-Range Wad Cutter bullet after cutting a paper card in two.*

"Kick" Does Not Cause a Miss

In Figs. XVI, XVII and XVIII (see page 12) is shown the Colt .45 caliber Automatic Pistol in various stages of firing. This cartridge is adapted to the .45 Colt Automatic Pistol, Thompson Sub-Machine Gun, also S. & W. and Colt 1917 D. A. Revolvers.

Fig. XVI (see page 12) Colt's .45 Caliber Automatic Pistol, Model of 1911. This spark photograph, taken after the cartridge had been fired and before the bullet emerged from the muzzle, clearly shows the leakage gas. This mushroom-shaped mass of leakage gas at the muzzle is not merely air which is being pushed out of the barrel; since a moment's consideration will show clearly that the volume of this gas, even when under considerable pressure, is several times that of the barrel. If this leakage gas were expanded until its temperature and pressure equalled that of the air in the barrel before firing, it is evident that the volume thus occupied would be many times that of the barrel.

Just ahead of the gas may be seen a few powder particles, probably left in the barrel, in this case, by a previous discharge and blown out by the blast of leakage gas.

The slide has just started to move back.

Fig. XVII (see page 12) Colt's .45 Caliber Automatic Pistol, Model of 1911. This photograph shows the bullet roughly four inches out of the muzzle. There is no evidence of the powder gas accelerating the bullet at this distance. Note that there has as yet been no appreciable upward movement of the muzzle. Such appreciable upward movement only occurs when the slide is arrested by the receiver and at this stage the bullet is several yards down the range. That is to say, other factors being equal, you will get a bulls-eye if you hold one and no amount of so-called kick ever encountered in practice can cause you to miss.

Fig. XVIII (see page 12) Colt's .45 Caliber Automatic Pistol, Model of 1911. This photograph shows the empty cartridge case being ejected. It has executed slightly more than one-half of a turn in its counter clockwise spinning motion. The impact of the slide causes the muzzle to tip upward.

Boat-tail and Flat Base Bullets

Fig. XIX (see page 14) shows a Peters .30 caliber M-1 172-grain boat-tail bullet and a 150-grain flat-base bullet moving through the air at a velocity of approximately 2,700 feet, or more than half a mile, per second.

FIG. XVI.—*.45 caliber Automatic Pistol, Model of 1911. Spark photograph taken after the cartridge had been fired and before the bullet emerged from the muzzle, showing mushroom-shaped mass of leakage gas at the muzzle.*

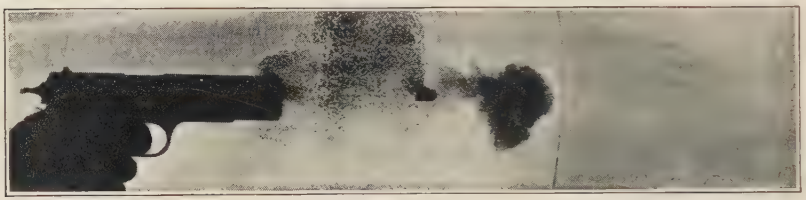


FIG. XVII. *Colt's .45 caliber Automatic Pistol, Model of 1911. Photograph showing the bullet roughly four inches out of the muzzle.*

FIG. XVIII.—*Colt's .45 caliber Automatic Pistol, Model of1911. Photograph showing empty cartridge case being ejected.*

A brief study of the bullet shapes and of the air disturbances just back of the base indicates that the stream-lined boat-tail would lessen the area of the partial vacuum just back of the base that is created by the flight of the bullet. Such a partial vacuum might be conceived as slightly retarding the bullet's flight. However, it is only after the velocity of the bullet has fallen below that of sound (roughly 1,100 feet per second) that there is an appreciable advantage through the reduction of this partial vacuum.

Consequently, it is in long-range firing (occasionally, the longest of sporting shots) that this is effective.

An Unusual Bullet

Not all the failures of various rifle and cartridge combinations are due to imperfections in the latter, and in this respect some very strange and unusual features are occasionally encountered.

Fig. XX (see page 15) shows a spark photograph of a .25-35 Soft Point bullet fired from a rifle whose barrel was twenty-six inches long and the pitch of the rifling was one turn in eight inches. The first ten inches of the lands and grooves of the rifling of this arm were almost worn away and the bore was quite rusty. It had apparently been greatly abused when submitted for test. The muzzle speed of this bullet was approximately 2,000 feet per second and the point at which this photograph was taken was roughly twenty feet from the muzzle.

When such a bullet is fired under ordinary circumstances from a rifle, the barrel of which is in good condition, the lands, or raised portions of the rifling, are forced into the metal jacket as it leaves the mouth of the cartridge case. Thus, its rotational acceleration increases directly with its acceleration along the bore when the rifling is of constant pitch. However, in this case the bullet moved through the first ten inches of the eroded portion of the barrel, in which the rifling was worn away, acquiring little if any rotational speed but a relatively great speed along the trajectory. Hence as the bullet entered the portion of the barrel in which the rifling still remained, the lands suddenly cut into its jacket and its rotation was violently accelerated, the shearing action being sufficient in this instance to rupture the bullet jacket. The heat thus generated, together with that of the friction of the rusty bore, was sufficient to melt at least a portion of the lead inside the metal jacket.

Due to centrifugal force, some of this molten lead issued from the aperture previously cut in the bullet jacket, in the form of a small stream. As this small jet of molten lead encountered the slip stream of the atmosphere through which it was passing, it was broken up into very minute particles each of which continued for a time to generate its own sound wave and wake as shown by the many parallel lines in the shaded portions of the bullet wake in the photograph.

Thus the bullet moved forward throwing out a finely divided spray of molten lead much in the manner of a pin-wheel moved in a direction at right angles to its plane of rotation.

The surface thus generated by this spiral spray of molten lead is not unlike that of a carpenter's auger or wood bit of which the bullet forms the point and the trace of the spiral spray of lead forms the body or twisted portion of the bit. The pitch of this spray is of course the same as that of the rifling, that is to say, one turn in eight inches.

The bullet itself does not follow the spiral of the lead spray, although it is probably forced to oscillate slightly about its tra-

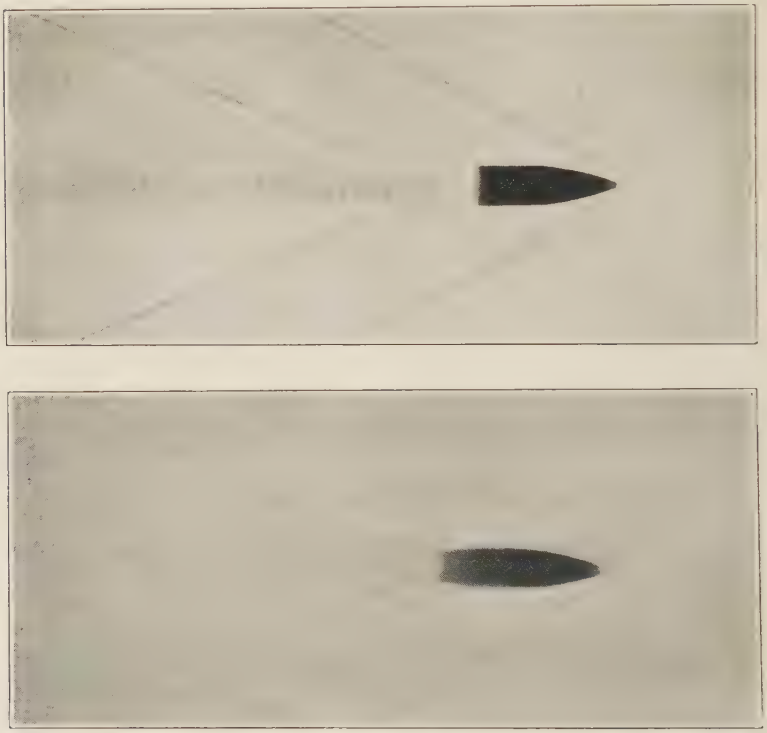


FIG. XIX.—*The upper print shows the old style .30-06 150-grain, flat base bullet formerly the standard of the Army. The lower print shows the new M-1 172-grain Boat-tailed bullet now in use.*

jectory due to the reaction of the lead spray which issues from the fractured jacket. The wake of the bullet immediately behind its base seems to bear this out. Due to the gyroscopic action of the bullet its instantaneous motion at a given point is not in the direction in which it is urged by the force due to the reaction of the lead spray but at ninety degrees to this direction. Thus the trace or wake of the lead spray should be not one hundred and eighty degrees from that of the bullet wake but only one-half this amount. The center of gravity of the bullet and spray system will trace out a smooth curve in space.

Approximately four feet farther along the trajectory from the point at which this spark photograph was taken, a sheet of paper

FIG. XX.—*This print shows the result of firing a jacketed bullet in a badly eroded barrel.*
(See text for complete description.)

was so placed that it was pierced by the bullet. A photograph of the original pattern of this particular bullet is reproduced on the photograph. It will be noted that the lead spray in the immediate vicinity of the bullet retained sufficient velocity to pierce the paper while that farther out had been so reduced in speed as to be barely capable ble of marking the paper.

With the phenomenal photographic equipment of the Peters Physical Laboratory, problems of this sort may be completely analyzed and the cause of the difficulty traced to its source.

Rim Fire Cartridges

The manufacture of good rim fire cartridges presents some of the most exacting requirements encountered in the manufacture of ammunition.

The temper of the cartridge case must be sufficiently hard to retain the bullet with a firm crimp. But if the case is too hard then not only are improper crimp and functional troubles likely to result but there is a loss in sensitivity in the firing of the cartridge. This is due to rim of the shell being too hard and thus resisting the blow of the firing pin instead of permitting it to suddenly compress a portion of the priming mixture and fire the charge.

The crimp of a shell which is too hard, will cut some of the bullet away, in firing, and often destroys the symmetry of the base. The gases from the muzzle-blast as the bullet emerges, will then cause the bullet to tip, as has been previously explained.

On the other hand, when the case is too soft the shell will stick in the chamber and extraction trouble will result, as well as other objectionable features. All of the factors we have just enumerated have to do with a proper anneal of the cartridge brass. The Peters Cartridge Company was a pioneer in the installation of the most accurate electric annealing furnaces. These furnaces not only bring the charge to the proper temperature but hold it at the proper value during the so-called "soaking" period. In addition to being fully automatic the recording controllers with which these furnaces are equipped record the temperature of the charge continuously thus permitting a check on any lot of shells at any time.

Great care is taken to obtain the proper hardness in the alloy composing the bullets which in turn are carefully swaged to size and lubricated with a special compound which prevents leading of the bore and insures accuracy, such as is obtained with Peters Tackhole and other cartridges.

For shooting galleries and other purposes Peters rim fire car-

tridges are available with rustless priming and copper-plated Gildkote bullets.

Peters Shotgun Shells

The Peters High Velocity and Target shells are unique in having a steel reinforcing cup inserted in the brass shell head which grips the paper tube and base wad thus forming an unusually strong shell head.

The priming and powder of these shells are such as to produce the maximum in pattern and range consistent with safety to the shooter.

The quality of the wadding used in a shotgun has been recognized as of the greatest importance since the days of Hawker and Manton.

While the shot charge is in the barrel and moving towards the muzzle under the pressure of the powder gases driving it, there is always a certain amount of gas leakage past the wadding. Such leakage establishes a relatively high pressure in the interstices of the shot pellets so that when the charge clears the muzzle, and is no longer subjected to the restraint of the barrel, this gas suddenly expands and in so doing imparts small outward velocities to the outer pellets of the charge. This outward velocity is relatively small but is operating on the pellets from the instant they leave the gun until they reach the target, so that over a range of 40 yards the pattern is certain to be impaired, sometimes quite seriously.

This effect is clearly illustrated in Figs. XXI and XXII (see page 18), which are spark photographs taken in the Peters Physical Laboratory of two High Velocity shells loaded with $3\frac{3}{4}$ drams equivalent, $1\frac{1}{4}$ ounces No. 6 chilled shot. In Fig. XXI (see page 18), the Peters new type wadding is shown having a relatively small gas leakage in the shot column itself. In Fig. XXII (see page 18), the gas which has leaked past the felt wads is excessive and is shown in this spark photograph disrupting the shot column. This factor is one which was apparently never even considered by some of the more voluminous writers on these subjects and yet it is one of the vital factors in obtaining good patterns.

The case of blown patterns due to pressure in the shot interstices is one of many instances where Spark Photography constitutes the only means by which we may determine precisely what forces act on the shot charge in the immediate vicinity of the muzzle. Heretofore it has only been possible to observe the resultant effect at the pattern, where in reality we see, not the effect of any one

FIGS. XXI AND XXII.—*These two spark photographs show the effect of inferior wadding the effects of which are explained in the text of this booklet.*

factor, but the composite effect of several. Now, by means of Spark Photography, we are able to study the various factors in ammunition performance one at a time. In fact the spark photograph is to the manufacturer of ammunition what the X-ray plate is to the surgeon. It provides the evidence for the diagnosis and it accomplishes this directly and without personal bias.

Shot for Peters shells is made in the Peters shot tower using alloys found from long experience to produce the desired degree of hardness. The finished shot are subjected to a thorough sorting and only those which meet the most exacting standards for roundness and hardness are accepted for production

The tubes used in all Peters paper shells are impregnated with a waterproofing compound which renders them impervious to moisture under all reasonable conditions. A firm bevel crimp assures satisfactory functioning in all types of repeating and automatic guns.

High Velocity Shell

This is the finest duck and goose load made. It reaches out and pulls down the high-flying-hard-to-get birds. There is nothing like it for speed, range and shocking power. It is loaded with progressive burning powder and is supplied in all the desired load combinations. In addition to the standard load Peters High Velocity may now be obtained loaded with Gildkote (copper-plated) shot in 10, 12, 16 and 20 gauge.

This copper plating of the shot insures a more satisfactory load. Owing to the extremely high velocity with which the shot leaves the muzzle of the gun in the High Velocity Shell, there is certain to be more or less deformity of the lead pellet, from crowding or jamming through the choke, which increases the possibility of an imperfect pattern and gives an opportunity for the game to slip unhit through the pattern, but with Gildkote Copper plated shot the tendency toward deformation of the pellet is reduced to the absolute minimum. Actual tests in the Ballistic laboratories prove scientifically that they produce much more uniform patterns. The shocking power and penetration of the shot is also increased by the Gildkote. These shells are highly recommended for long range game shooting.

Target Shell

This shell has long been a favorite with field shooters and has been used by many winners at the traps, including the greatest of

all trap-shooting events—The Grand American Handicap. It is loaded with smokeless powder in all standard loads, and will give satisfaction for all small game and trap shooting.

Peters Target Gildkote Shell

Peters Target Gildkote (Copper-plated Shot) Handicap Load is the load that created a sensation at the Grand American Handicap. Hundreds of shooters who had never used anything but lead shot heard people talking about Gildkote and decided to try it out. In a great many instances they tried it out in practice events and immediately decided to use it in the main event. Others started and continued to use Gildkote as soon as they saw it. The results in every case were highly satisfactory. Handicap shooters particularly recommend Gildkote. The man or woman shooting from the 16 yard line need not be nearly so concerned about his or her pattern as does the shooter who is placed from five to seven yards back. Shooting from the 23 yard line for instance, a good pattern may make all the difference in being champion or just one of those who shot. Don't fail to get your share of broken targets by using the Gildkote Handicap Load.

Victor Shell

A low priced Smokeless shell that embodies many of the Peters features; for trap shooting, rabbits, squirrel, dove, quail and other small game, it is most desirable, sure-fire and dependable. It is far better than its low price would indicate. It will reduce your shell expense and for many kinds of shooting prove the ideal load.

The Stringing of Shot

For clay bird shooting the Peters shells are unsurpassed. Fig. XXIII (see page 21) shows a Peters shot string shattering a clay-bird to dust.

It has, of course, been recognized for more than a hundred years that a charge of shot not only spreads out laterally after leaving the muzzle, but that some portion of the pellets fall farther and farther behind the head of the shot column until at very long ranges the length of the shot string may be excessive.

As long as the rearmost pellets of the shot column do not fall below the killing velocity a shot string of reasonable length is a great advantage, since in case one leads the target or bird a little

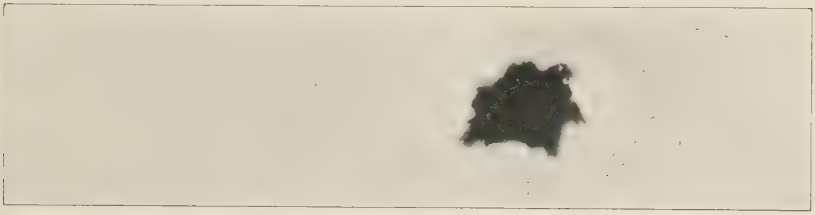


FIG. XXIII. *This spark photograph shows the shot string from a Peters shell shattering the clay target to dust. Where even a small portion of the total string is capable of pulverizing the target in this manner it is evident that a shot string of appreciable length is of inestimable advantage since in case one leads the bird a little too far a shot string of reasonable length will still score a hit, thus providing the shooter with an additional chance of getting his bird.*

too far, a shot string of reasonable length—say twelve to fifteen feet—will still often make his kill and will thus provide him with an additional chance of getting his bird.

Many years ago an Englishman wrote on this subject, "If Shot Flew Sideways through the Air like a Dinner Tray you would Kill no Crossing Birds." The truth in this statement will be evident to the most casual observer.

Of course if the target is moving either directly away or directly towards the shooter the length of the shot string is of no importance as long as the rearmost pellets do not fall below the killing velocity. However, in general a shot string of reasonable length is of inestimable advantage in shooting at the so-called quartering or angle birds and unquestionably the success of many accomplished duck shooters, whether they admit it or not, is often to be attributed fully as much to the game actually flying into the shot as it is to the shot being perfectly aimed.

Fortunately for the users of all shotgun ammunition of whatever make there are no short shot strings. Nor are there any shot strings in which the shot are concentrated at the head of the column. There are, of course, more shot pellets *toward* the forward end of the string but there is no concentration in this region. In fact with No. 6 or 7 chilled or Gildkote shot at a range of forty yards approximately 50 per cent of the pellets will be distributed over an average distance of 3.6 feet. In short the "short shot string" as well as the "concentrated shot string" somewhat resemble the fabled Phoenix in that they are never met with in practice.

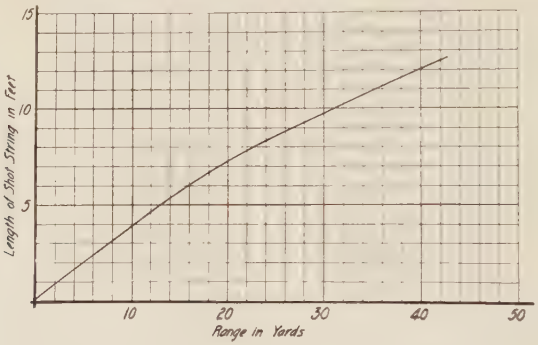


FIG. XXIV.—*Range—Shot String Curve for No. 6 or 7 chilled or copperplated shot.*

The plating of shot with copper or nickel in no way appreciably affects the length of the shot string although it does, of course, increase the hardness of the pellets.

For the benefit of those interested, the foregoing remarks were convincingly demonstrated with actual photographs in the May and June issues of The American Rifleman for 1928. The data published on this subject at that time has been supplemented by extensive similar tests in the Physical Laboratory of The Peters Cartridge Company with both chilled and plated shot. The results of these tests have been such as to amply confirm our earlier conclusions and the results of all of this material as relates to No. 6 and 7 chilled or plated shot have been incorporated in the curve shown in Fig. XXIV (see above).

There is available at present no direct method of measuring shot strings except that of spark photography. This method records permanently, and in approximately one-millionth of a second, the actual distribution of the shot pellets at any particular instant desired. It is evident that the company possessing this equipment is very advantageously placed not only as regards tests of their own product but that of their competitors as well.

Fig. XXV (see page 23) shows two actual spark photographs of shot strings at a range of twenty yards from the muzzle. The pellets of both of these strings were copper plated.

The curve in Fig. XXIV (see above) represents the average length of the shot string for No. 6 or 7 chilled or copper plated shot when used in the best grade of shells up to and including a range of forty yards.

FIG. XXV.—*Spark photograph showing two copper plated shot strings.*

From this curve it will be readily seen that at a range of forty yards the average length of the shot string for No. 6 or 7 chilled or copper plated shot is 12 feet.

It should also be noted that the curve is still inclined sharply upward at the forty yard range, clearly showing the rate of increase in shot string length as the fifty and sixty yard ranges are approached. Neither is it possible as has sometimes been claimed for the shot string to shorten itself appreciably in some miraculous way after once having attained a given length.

That is to say at a range of forty yards a shot string for No. 6 or 7 shot of any type will be at least 12 feet long and this length will increase steadily as the longer ranges are approached.

Peters Rustless Cartridges

For some time users of Peters .22 caliber cartridges have had the benefit of the Rustless feature made possible by a non-corrosive and non-rust-producing priming mixture, developed in the Peters Chemical Laboratory. Results secured with these cartridges have been so satisfactory that all of the more popular rim and center fire sizes are now supplied with the Rustless primer.

Peters Rustless Gildkote 22's

Peters Rustless Gildkote (Copper-plated) .22's have already made a big name for themselves.

Now you can buy a cartridge that will not rust, pit, corrode, or lead the barrel. Just think what this means!

Gildkote goes a step farther than Rustless. With lead bullets there is always the chance of leading the barrel . . . and a barrel that has been so fouled is extremely difficult to get back into first-class condition. The copper plating or Gildkote (lubricating coat) completely protects the barrel.

Thousands upon thousands of rounds may now be shot without giving even a thought to cleaning the barrel. The Rustless priming mixture eliminates salts which attract moisture and cause rust.

Gildkote .22's may be carried loose in the pocket if desired. It is impossible to do this with grease lubricated bullets because of the general messiness which is sure to follow. Greasy hands, greasy pockets, dirt adhering to the bullets and getting into the gun with a consequent loss of accuracy . . . these are some of the things which Gildkote has eliminated.

These advantages demonstrate beyond reasonable doubt the superiority of this new addition to the Peters Line.

Spark Photographs by PHILIP P. QUAYLE,
Chief Physicist of The Peters Cartridge Co.

To the Shooter

When you have read this booklet and studied the evidence of these history-making spark photographs, the only method of showing what actually does happen after the trigger is pulled, you will realize that the Ⓟ Brand carries a definite assurance of ammunition excellence based on scientific knowledge hitherto unavailable to any manufacturer and now available only to

The Peters Cartridge Company

PETERS
AMMUNITION

—Ammunition You Can Shoot
With Confidence